REMARKS/ARGUMENTS

With the request for continued examination filed on March 11, 2009, Applicants filed a request for suspension in order to collect additional experimental evidence in support of the patentability of the present invention. Applicants have now collected that evidence and ask that this application be examined based on the amendments filed on March 11, 2009, the following comments, and the enclosed declaration of inventor, Dr. Hiroshi Yoshioka.

I. Introduction

As a preliminary matter, for effective cultivation of a plant, it is very important to appropriately control and maintain the rhizosphere environment of the plant as explained in detail at page 2, line 22 to page 4, line 34 of the specification as filed. Further, attention is drawn to the specification at page 21, line 27 to page 22, line 7 which reads as follows:

> In the plant-cultivating soil which is to be used on condition that wet and dry states are alternately provided, the amount of oxygen in the soil is increased in the dry state, and the soil actively absorbs plant nutrients as an energy source of roots. In this state, however, plant nutrients, which are present in ionic form, are less likely to be absorbed by the plant due to insufficient soil humidity based on the dry state thereof. On the other hand, when the soil moisture is in a saturated state, plant nutrients are more likely to be absorbed by the plant, but the saturated water in the soil invites an oxygen-deficient state of the soil, and the energy which is required for the activity of absorbing in the root is decreased or becomes insufficient. In order for a plant to favorably absorb the plant nutrients present in the planting material, the presence of both suitable effective soil gas and soil moisture is important." (emphasis added)

Thus, for facilitating plant growth, balance of "soil gas" and "soil moisture" is very important. Conventionally, complicated and expensive facilities are used in an attempt to

achieve good balance of "soil gas" and "soil moisture". However, even when such complicated and expensive facilities are used, it has been very difficult to achieve such good balance.

According to the claimed invention, the present inventors have unexpectedly found that good balance between soil gas and soil moisture can be easily achieved and maintained for a long time simply by supplying water in a water tank to a plant through a non-porous PVA film placed between the water and the plant.

II. Rejections under 35 U.S.C. §103

In the Office action dated November 20, 2007, the Examiner rejected claims 1-7 and 12 as obvious over Weder et al. (U.S. 5,363,592) in view of Schur (U.S. 3,097,787) and Caldwell et al. (U.S. 2,773,050). Claims 8-11 were rejected as obvious over Sakai (JP 7-45169) in view of Weder et al., Schur, and Caldwell et al. In response, Applicants have carefully reviewed all claims, and have amended claims 1-5 and 8-11 for clarity, and have canceled claims 6, 7, and 12. No new matter has been added.

In rejecting independent claims 1 and 8, the Examiner recognizes that neither Weder et al. nor Sakai describe the use of a non-porous polyvinyl alcohol (PVA) film as recited in claims 1 and 8 of the present application. However, the Examiner asserts that because Weder et al. describe the use of a cellulose film, it would have been obvious for one of ordinary skill in the art to replace the cellulose film described in Weder et al. by "a longer lasting material", such as a PVA film as taught by Schur and Caldwell et all. Applicants respectfully traverse.

As can be seen from claims 1 and 8 of the present application, as amended on March 11, 2009, the plant-cultivating system of the present invention is characterized in that "a non-porous hydrophilic film made of a material selected from the group consisting of polyvinyl alcohols and copolymers thereof" (referred to here as a "non-porous PVA film" for brevity) is provided in a water tank such that cultivation of a plant can be performed while supplying water to a plant through the non-porous PVA film. In the present invention, simply by supplying water in the water tank to a plant through such a non-porous PVA film, the rhizosphere environment, and in particular, the humidity and oxygen concentration, can be easily and favorably maintained for

prolonged periods, even without directly supplying water to the culture soil disposed in the film. This enables the very rapid and full growth of a plant with less water. See page 1, lines 13 to 19 of the present specification and the Working Examples of the present application.

In contrast, Weder et al. describe the use of "a polypropylene film" and "cellophane" (col. 2, lines 50 to 52) as a "liner" used in a container for a propagule and a growing medium. Similarly, Sakai describes the use of "a silicone film, a cellulose acetate film (cellulose-type film) and a polyimide film" (col. 5, lines 9 to 16) as a water vapor permselective film which may be combined with a waterproof moisture-permeable film, such a porous polytetrafluoroethylene film. However, by the use of such films as described in these references, the rhizosphere environment cannot be favorably controlled for a long time. In addition, neither Weder et al. nor Sakai has any teaching or suggestion about the control of the rhizosphere environment (such as humidity and oxygen concentration) by supplying water to a plant through such films as described in these references to the plant.

Further, Schur and Caldwell describe a PVA film but fail to teach or suggest that any advantage would be obtained by using a non-porous PVA film for cultivation of a plant. In addition, Sakai teaches away from the substitution of a non-porous PVA film for a cellulose-type film by teaching the use of cellulose, silicone, or polyimide films.

Thus, the excellent results achieved by the use of a non-porous PVA film are neither taught nor suggested by any combination of the cited references including Schur and Caldwell and, hence, are unexpected and surprising.

In order to substantiate this argument, the Applicants have conducted comparative experiments and observations. The method and results of the comparative experiments and observations are as described in the Exhibit accompanying the Declaration of Dr. Yoshioka that is submitted with this response.

Specifically, in Exhibit 1 of Dr. Yoshioka Declaration, experiments were conducted to evaluate plant growth using a non-porous PVA film recited in claim 1 of the present application and various films described in Weder et al. and Sakai.

Dr. Yoshioka's declaration clearly shows the following:

(1) The system of the present invention is advantageous in that, simply by supplying water in the water tank to a plant through such a non-porous PVA film, the rhizosphere environment (such as humidity and oxygen concentration) can be easily and favorably maintained for a long time even without directly supplying water to the culture soil disposed on the film, thereby enabling very rapid and full growth of a plant with less water. See Experiment 1A shown in Table A of Exhibit 1 of the Yoshioka Declaration, Experiment 1 of the 1st Okamoto Declaration submitted with the response filed on January 20, 2004 and shown in Table B of Exhibit 1, and Experiment 3 of the 2nd Okamoto Declaration submitted with the response filed on August 15, 2005 and shown in Table B of Exhibit 1.

(2) In contrast, a porous hydrophobic film such as a polypropylene film as described in Weder et al. or a PTFE film as described in Sakai cannot transmit a sufficient amount of moisture. See Comparative Experiment 1A shown in Table A of Exhibit 1, and Experiment 1 of the 1st Okamoto Declaration shown in Table B of Exhibit 1. Furthermore, a polypropyl film or a PTFE film is likely to lose its impermeability to liquid water during the cultivation of a plant, so that such porous hydrophobic films cannot be used for maintaining favorable rhizosphere environment (such as moisture and oxygen content) for prolonged periods of time. See Experiment 1 of the 1st Okamoto Declaration shown in Table B of Exhibit 1.

(3) Even if a microporous hydrophobic film is hydrophilized, the resultant film freely passes water therethrough so that such a hydrophilized film cannot be used for controlling the rhizosphere environment of a plant. See Experiment 2 of the 1st Okamoto Declaration shown in Table B of Exhibit 1.

(4) Furthermore, water vapor permselective films, such as silicone films, polyimide films or cellulose acetate films such as are described in Sakai cannot supply sufficient amount of water to the plant through the film. See Comparative Experiments 2A and 3A shown in Table A of Exhibit 1. Plant growth using any of such films is poor.

(5) Still further, a cellophane film such as is described in Weder et al. is broken when used in a manner as in the system of the present invention. See Experiment 2 of the 2nd Okamoto Declaration shown in Table B of Exhibit 1.

From the five points set forth above, it is apparent that the use of a non-porous PVA film as claimed provides exceptional results that are unexpected over the cited art.

In addition, it should be noted that, as already mentioned above, Schur and Caldwell describe a PVA film but fail to teach or suggest that any advantage will be obtained by using a non-porous PVA film for cultivation of a plant. Furthermore, Weder et al. use such films only as a liner, but fail to teach or suggest the supply of water to plants through such films. Moreover, Sakai uses the films for removing harmful substances including harmful gases, thus teaching away from the use of non-porous PVA film which exhibits very poor gas barrier property at a high humidity.

Thus, none of the prior art references cited by the Examiner (including Schur and Caldwell), either alone or in combination, teaches or suggests the above-mentioned unexpected results achieved by the use of a non-porous PVA film. Therefore, it is apparent that the present invention is not obvious over the cited prior art references.

III. Conclusion

From the foregoing, it is firmly believed that all of the Examiner's rejections have been overcome. Early and favorable action is respectfully requested.

Respectfully submitted,
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